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(57) Claims

1 A functional axis composed from a cylinder formed in a cylinder shape in advance and having through-holes pierced into its outer circumference wall, a functional element A formed in advance, and a synthetic resin part for which this functional element A and cylinder are placed within an injection molding mold, and for which a melted synthetic resin is injected with

[redacted]

functional element A placed near one end of the cylinder, thus forming the synthetic resin part with the functional element A and cylinder as a single unit, wherein this synthetic resin part is composed from an axial core part formed inside the cylinder while also being formed as a single unit with functional element A via one end of the cylinder, and from functional element B that is a projection formed in continuation with the outside of the cylinder passing through said through-hole from this axial core part, and being formed from materials different from those of functional element A.

2 The functional axis of claim 1 wherein functional element A is made from a material that is different from the synthetic resin that forms functional element B.

3 The functional axis of claim 1 wherein functional element A is made from the same material as the synthetic resin that forms functional element B.

4 The functional axis of claim 1 wherein functional element A is formed from a material for which the material properties are different from the synthetic resin that forms functional element B.

5 The functional axis of claim 1 wherein the cylinder is made of metal.

6 The functional axis of claim 1 wherein it is an axis for power transmission.

Detailed Description of the Invention

The present invention concerns a functional axis that has a strong structure and for which is used a synthetic resin which can be obtained with easy manufacturing, and more particularly concerns a functional axis composed from a cylinder, a functional element A provided as a single unit with the cylinder, and a synthetic resin part positioned inside and outside the cylinder and provided as a single unit with the cylinder, wherein the synthetic resin part positioned inside and outside the cylinder continues through the through-holes provided on the cylinder, and the synthetic resin

parts positioned on the outside forms functional element B at a position near the through-holes.

Synthetic resins which are light as well as excellent in terms of formability are widely used as a construction material for things such as axes for power transmission for which cams and gears are provided on an axis rod or on various fans for which fan rotors are provided on an axis rod. Specifically, the axis rod is constructed using a synthetic resin, or a synthetic resin functional element is attached separately to a metal axis rod, or an axis rod and functional element are formed by insertion as a continuous single unit using synthetic resin. With items for which the functional element is attached separately, there are cases when the attached part becomes loose when used for a long time, and especially when the functional element is a power transmission part such as a cam or gear, there is always force applied, so the loosening occurs quickly, so it is very troublesome to attach these items strongly enough so as not to loosen. In comparison, when the axis rod and functional element are formed by insertion using synthetic resin as a single unit, there is always some occurrence of slight distortion due to things such as the contraction difference between the resin and the solid rod, the torque, or the positioning shape, and there are cases when there is skew from the center positions due to things like injection pressure when the solid rod for reinforcement is formed, and if an item like this is used, when rotation occurs, there are problems of vibration occurring. When we look at these cases, we see that none of the aforementioned three types of prior art products could be used satisfactorily, and improvements were needed.

The purpose of the present invention is to provide a functional axis that solves the disadvantages of the prior art products described above and that is made using synthetic resin.

The functional elements referred to as functional element A and functional element B for the present invention mean elements that, when using an axis that has a function such as a power transmission axis rather than a cylinder that is simply an axis, are provided to perform a certain function for the functional axis.

Following we will give a detailed description of the present invention while using the figures of working examples, but the present invention is not limited to the following working examples.

Figures 1 and 2 show a working example of functional axis 1, which is composed from cylinder

2, functional element A 3 and synthetic resin part 4. Synthetic resin part 4 is composed from synthetic resin part 4a positioned inside the cylinder and from synthetic resin part 4b which is positioned outside the cylinder, and synthetic resin part 4b positioned on the outside forms functional element B 5. Functional element A 3 is formed in a pulley shape, while functional element B 5 is formed in a roller shape, and functional element A 3 is made from metal or hard synthetic resin, while functional element B 5 is made from a synthetic resin that has a slightly soft elasticity. Roller shaped functional element B 5 is made from a synthetic resin that has slightly soft elasticity to increase adhesiveness because of sending plates, etc., and in comparison, the pulley-shaped functional element A 3 on which a belt is attached and rotates must not become distorted, so is made from metal or a hard synthetic resin.

While we explain the manufacturing process of the aforementioned functional axis 1 below (shown in Figure 3), we will also discuss the merits in terms of manufacturing.

When doing injection molding, there are fixed molds and moving molds, and cylinder 2 as well as functional element A 3 as a single unit with cylinder 2 are installed within fixed mold X, and then from the front, moving mold X' (not illustrated) is installed to match mold X. Y is a cavity for forming functional element B 5, 6 is a through-hole in cylinder 2, and Z is an injection port for melted synthetic resin.

Here, when melted synthetic resin is injected using injection port Z, synthetic resin parts 4a and 4b positioned on the inside and outside of cylinder 2 are provided continuously through through-hole 6, and internal synthetic resin part 4a is coupled in a fixed state at one end with functional element A 3. By using this kind of manufacturing method, it is possible to obtain cylinder 2, functional element A 3, and synthetic resin part 4 as a single unit when doing injection molding, so manufacturing workability is excellent.

When doing melted synthetic resin injection, high pressure is applied to the inside of the cylinder, but most of this contacts the inner surface of the mold, so there is no deformation, and it is not necessary to make the structure of the cylinder all that strong to withstand the resin pressure, so it is possible to use a relatively inexpensive thin wall pipe.

Furthermore, there is large thermal contraction for the synthetic resin part, but the internal

synthetic resin part passes through the through-hole and continues to the external synthetic resin part to become fixed, so the contraction in the lengthwise direction of the cylinder for which there is the greatest concern is suppressed, and the external synthetic resin part is small, so the contraction is small, and thus it is possible to obtain an overall product which is excellent in terms of dimensional accuracy, making things very easy in terms of forming technology as well.

Besides aluminum material for cylinder 2, it is also possible to use a metal material such as copper material or annealed copper material, or thermally hardened or thermally resistant resin pipe, but it is preferable to use a metal material from the standpoint of having excellent rigidity and being excellent in terms of thermal resistance when doing forming. The materials for functional element A 3 and synthetic resin part 4 are selected as appropriate according to the function specified for functional axis 1, so for the material for functional element A 3, metal or various thermally resistant resins are used, and as the material for synthetic resin part 4, general purpose resins such as polypropylene resin and polyethylene resin or fully thermally plastic resins such as polyacetal resin and noryl resin are used. Figure 4 shows another working example, where functional element A 3 is a gear with teeth around the entire circumference, functional element B 5 is a gear with teeth only in two directions, and when doing forming, by placing functional element A 3 inside a disk shaped cavity for which the teeth do not engage within the mold, it is possible to remove this from any direction from within the mold. Also, to avoid undercut during mold removal, the gears of functional element B 5 are provided with teeth only in two directions that correlate to the mold removal direction (shown by arrows). The kind of structure shown by this working example can be implemented when one wants to obtain various functional elements using the same synthetic resin material, and when mold removal is not easy due to undercut in the various functional elements. 7 and 7' are sliding parts, with one being provided as a single unit with functional element A 3 and the other as a single unit with synthetic resin element 4.

It is acceptable to use the same material for functional element A 3 and functional element B 5, or to use different materials, or to use items with different physical properties. Physical properties which are at issue are things such as hardness and anti-wearing properties, and as described above, with the item shown in figure 1, a material with a large degree of hardness is used for

functional element A 3, and an item with a small degree of hardness and which has elasticity is used for functional element B 5, and the materials can be selected to have functional element A 3 and functional element B 5 show even more sufficient functioning. It is also acceptable to have multiple items as well as multiple types of functional element A 3 and functional element B 5.

Figures 5 and 6 show other working examples with functional element A 3 attached to cylinder 2, and for the item shown in figure 5, ring shaped groove 9 is provided on the attachment introduction part 8 of functional element A 3, and the synthetic resin part 4 is in a state where it bites into this groove 9, making the structure such that functional element A 3 is firmly fixed to cylinder 2. The attachment introduction part 8' of functional element A 3 shown in figure 6 is structured in a flat manner, and both ends of this attachment introduction part 8' are provided so that they engage with notch 10 which is provided in a direction correlating with the end of cylinder 2, and the rotational direction force of functional element A 3 is set to be received by cylinder 2, so this is effective when axis 1 is a power transmission axis and functional element A 3 has a rotation function. Also, when the fixing of functional element A 3 to cylinder 2 needs to be very strong, it is acceptable to use a vis or the like, but when performing molding of synthetic resin part 4, this can be done using the adhesiveness of the melted resin.

Figure 7 shows another working example of the structure near through-hole 6 of cylinder 2, where the edge 11 of through-hole 6 within synthetic resin part 4b placed outside cylinder 2 rises up and is bitten into, and with this structure, compared to the structure shown in the cross section diagram of figure 2, the functional element B 5 made from external synthetic resin part 4b is provided more strongly fixed to cylinder 2. Figure 8 shows the through-hole 6 (generally 1 to 5 mm ø) provided on cylinder 2 shown in figure 2, and figure 9 shows the through-hole 6 of the item shown in figure 7, where compared with the former which is round, the latter is formed in approximately a cross shape. Specifically, for the latter, when performing molding, when the high output of melted resin (the melted synthetic resin pressure for normal injection molding is 250 to 600 kg/cm^2) for forming synthetic resin part 4b that is outside cylinder 2 passes through through-hole 6 and flows to the outside, the edge 11 of that through-hole 6 is raised up by that pressure. Figures 10, 11, and 12 show other working examples of through-hole 6 having a structure with which the edge 11 is raised up, but the fact that cutting part 12 becomes long in the

axial direction of cylinder 2 is not desirable because it decreases the strength of cylinder 2. The through-hole 6 shown in figure 12 opens when resin injection is performed. Also, as described above, the rising shape of edge 11 is formed during molding, but it is also acceptable to provide this at the same time as providing through-hole 6 by die cutting.

For the working examples described above, the functional axis 1 was a power transmission axis, and it is acceptable to have the other functional element A 3 and functional element B 5 be things such as a gear, pulley, roller, or cam as appropriate. Other conceivable working examples include a horizontal cross flow fan with an air conditioning function or an axis for a noodle press-cut manufacturing machine.

The present invention is a functional axis with a structure as described above, and can be obtained with easy manufacturing and can be used with a cylinder as the framework, so there is no worry of distortion, and vibration does not occur when rotating. Also, functional element B is provided firmly because it is continuous with the synthetic resin part inside the cylinder, and it also has functional element A provided separately from this functional element B, so it can exhibit a wide variety of functions.

Brief Description of the Figures

Figure 1 is an oblique diagram of a working example of the present invention. Figure 2 is a vertical cross section diagram of the same working example. Figure 3 is a summary side diagram that explains the manufacturing status of the present invention. Figure 4 is a side diagram of another working example. Figures 5 and 6 are oblique diagrams of working examples with functional element A attached. Figure 7 is a vertical cross section diagram showing near the through-hole of the cylinder of another working example. Figure 8 is a planar diagram showing the through-hole of the items shown in figure 2. Figure 9 is a planar diagram showing the through-hole of the item shown in figure 7. Figures 10, 11, and 12 are planer diagrams of the through-holes of other working examples.

Explanation of Codes

1 Functional axis

2 Cylinder body

3 Functional element A

4 Synthetic resin part

5 Functional element B

6 Through-hole

[Please refer to original document for Figures 1 to 12 — Translator's note]

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㊼特許請求の範囲

1　予め筒状に成形され、その外周壁に通孔を穿設してなる筒体と、予め成形された機能部材Aと、この機能部材A及び筒体を射出成形型内に設置し、しかも機能部材Aを筒体の一方端近傍に配した状態にて溶融合成樹脂を注入することによつて、機能部材A及び筒体と一体に成形される合成樹脂部とからなり、

この合成樹脂部は、筒体の内部に成形されると共に筒体の一方端を介して機能部材Aと一体に成形される軸芯部分と、この軸芯部分から前記通孔を通して筒体の外部に連続して突出成形され、機能部材Aとは別異の部材を構成する機能部材Bとからなる機能軸体。

2　機能部材Aが、機能部材Bを構成する合成樹脂とは異なる材料よりなる特許請求の範囲第1項記載の機能軸体。

3　機能部材Aが、機能部材Bを構成する合成樹脂と同材料よりなる特許請求の範囲第1項記載の機能軸体。

4　機能部材Aが、機能部材Bを構成する合成樹脂とは物性を異にする材料よりなる特許請求の範囲第1項記載の機能軸体。

5　筒体が金属よりなる特許請求の範囲第1項記載の機能軸体。

6　動力伝達用軸体である特許請求の範囲第1項記載の機能軸体。

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発明の詳細な説明

この発明は構成が強固で、しかも製造容易に得られる合成樹脂を用いてなる機能軸体に関するもので、さらに詳しくは、筒体と、筒体に一体に設けられる機能部材Aと、筒体の内部と外部とに位置して筒体に一体に設けられる合成樹脂部とからなり、筒体の内部と外部とに位置する合成樹脂部は筒体に設けられた通孔を通して連続するとともに、外部に位置する合成樹脂部は通孔の近傍位置において機能部材Bを構成する機能軸体に関するものである。

軸棒にカムやギヤが設けられた動力伝達用軸体や、軸棒にフアンロータが設けられる各種フアン等の構成材料として、軽量で成形性に優れる合成樹脂が広く使用されている。すなわち、軸棒を合成樹脂により構成したり、金属製の軸棒に合成樹脂製の機能部材を別個に取り付けて用いたり、さらには、軸棒と機能部材とを合成樹脂により連続一体にインサート成形したりしている。機能部材を別個に取り付けたものは、長期の使用において取り付け部が緩る場合があり、とくに機能部材がカムやギヤ等の動力伝達部である場合常に力がかかるので緩みが早いもので、これを緩まないように強固に取り付けるには非常に手間がかかつた。これに対し軸棒と機能部材とが一体に合成樹脂でインサート成形により構成されている場合、どうしても樹脂と中実棒との収縮差や回り止めや位置

決めの形状等により若干歪む場合があるとともに、補強用の中実棒が成形時の射出圧力等により中心位置からずれる場合もあり、このようなものを用いると回転の際に振れが起り困るものであつた。こうしてみると、上記した三種の従来品のものはどれについても使用上満足されないもので、その改良が待たれるものであつた。

この発明は、上述の従来品の欠点を解消する、合成樹脂が用いられてなる機能軸体を提供するべくなしたものである。

この発明にいう機能部材A、機能部材Bの機能部材とは、筒体を単なる棒体にとどめることなく動力伝達軸等の機能を果す軸体とする場合に、その機能軸体が所望の機能を果すべく設けられる部材を意味するものである。

以下この発明を実施例図面により詳述するが、この発明は以下の実施例に限定されるものではない。

第1図、第2図は機能軸体1の実施例を示し、筒体2と機能部材A3と合成樹脂部4とからなる。合成樹脂部4は筒体の内部に位置する合成樹脂部4aと、外部に位置する合成樹脂部4bとからなり、外部に位置する合成樹脂部4bが機能部材B5を構成する。機能部材A3はプーリー状に構成され、機能部材B5はローラー状に構成されており、機能部材A3は金属もしくは硬質の合成樹脂よりなり、機能部材B5は若干軟質の弾性を有する合成樹脂よりなる。ローラー状の機能部材B5は板体等を送る故に密着性が高まるべく若干軟質の弾性を有する合成樹脂により構成されており、これに対しベルトがかけられ回動するプーリー状の機能部材A3は歪んだりしてはならないので金属や硬質の合成樹脂により構成されるものである。

以下上記機能軸体1の製造工程を第3図により説明するとともに、この製造上のメリットについて述べる。

射出成形時には固定型および移動型とが有り、固定型X内に筒体2と筒体2と一体に機能部材A3とを装着し、次いで手前方向より移動型X'(図示しない)を型Xに合致させるべく装着する。Yは機能部材B5を形成するためのキャビテイであり、6は筒体2の通孔、Zは溶融合成樹脂の注入口である。

そこで、注入口Zより溶融合成樹脂を注入すると、筒体2の内部と外部とに位置する合成樹脂部4a，4bが通孔6を通して連続して設けられ、内部の合成樹脂部4aは一端では機能部材A3と固着状態に接合する。このような製造方法によると、筒体2と機能部材A3と合成樹脂部4とが射出成形時に一体化されて得られるので、製造作業性がきわめて良好である。

溶融合成樹脂注入時には筒体に内側から高い圧力が加わるが、大部分が型内面に接しているので変形することがなく、このことは樹脂圧力に耐えるべく筒体をそれほど強固な構成にする必要がないので比較的安価な薄肉パイプの使用が可能である。

さらに、合成樹脂部は熱収縮が大であるが、内部の合成樹脂部は通孔を通して外部の合成樹脂部と連続して固定された状態となつているので、最も懸念される筒体の長手方向への収縮は押えられ、また外部の合成樹脂部は小形であるので収縮は小さく、よつて全体として寸法精度に優れたものが得られ、また、成形技術的にも非常に容易である。

筒体2としてはアルミ材の他、銅材、軟鋼材等の金属材、熱硬化性または耐熱性の樹脂パイプも用いることができるが、剛性に優れ、成形の際に耐熱性に優れるという点において金属材を用いることが望ましい。機能部材A3と合成樹脂部4との材料は、適宜機能軸体1の所望される機能により選択されるもので、機能部材A3の材料としては金属や種々の耐熱性の樹脂が用いられ、合成樹脂部4の材料としてはポリプロピレン樹脂、ポリエチレン樹脂等の汎用樹脂およびポリアセタール樹脂、ノリル樹脂等の全ての熱可塑性樹脂が用いられる。第4図は他実施例を示すもので、機能部材A3は全周に歯を有するギヤであり、機能部材B5は二方向にのみ歯を有するギヤであつて、成形の際機能部材A3を型内の歯の切り込みのない円板状のキャビテイ内に位置さすことにより型内より任意の方向に抜けるようにするものである。なお機能部材B5のギヤには型抜の際アンダーカットにならないように歯は型抜き方向（矢印で示す）である相対する二方向にのみ設けられている。この実施例のような構成は、同一の合成樹脂材料により、種々の機能部材を得たい場合で、し

かも種々の機能部材のなかにアンダーカットとなって容易に型抜きができないものがある場合に実施すればよい。7，7′はそれぞれ摺動部であり、一方は機能部材Ａ３に他方は合成樹脂部４に一体に設けられている。

機能部材Ａ３と機能部材Ｂ５とは同材料のものを用いてもよく、異なる材料のものを用いてもよく、また、物性の異なるものを用いるようにしてもよいものである。物性としては硬度、耐摩耗性等を問題とするもので、上記したように第１図に示したものでは機能部材Ａ３に硬度の大なるものを用い、機能部材Ｂ５に硬度が小でしかも弾性を有するものを用いたもので、機能部材Ａ３、機能部材Ｂ５がより十分に機能を果すべくその材料が選択されればよい。また機能部材Ａ３、機能部材Ｂ５とも複数個であつても複数種類であつてもよい。

第５図、第６図は筒体２への機能部材Ａ３の取り付け状態の他実施例を示すもので、第５図に示すものにおいては機能部材Ａ３の取付挿入部８に輪状に溝部９が設けられ、この溝部９に合成樹脂部４が喰い込む状態となつて機能部材Ａ３が筒体２に強く固定されるべく構成されている。第６図に示す機能部材Ａ３の取付挿入部８′は扁平に構成されており、その取付挿入部８′の両端が筒体２の端部に相対向して設けられた切欠き部１０に嵌設されたように設けられるもので、機能部材Ａ３の回転方向の力は筒体２により受ける状態となるので、軸体１が動力伝達用軸体で機能部材Ａ３が回転機能を果すものである場合有効である。なお、筒体２への機能部材Ａ３の固定は、強度が大なる固定が望まれる場合はビス等によつてもよいが、合成樹脂部４の成形の際にその溶融樹脂の固着性を利用しておこなえばよい。

第７図は筒体２の通孔６付近の構成の他実施例を示し、筒体２の外部に位置する合成樹脂部４ｂ内に通孔６の縁部１１が立ち上がつてくい込んでおり、この構成の方が第２図の断面図に示す構成より外部の合成樹脂部４ｂなる機能部材Ｂ５がより強固に筒体２に固定され設けられる。第８図に示すものが第２図に示すものの筒体２に設けられる通孔６（一般的に１～５㎜φ）を示し、第９図に示すものが第７図に示すものの通孔６を示し、前者は円形であるのに対し、後者は略十字状に形成されており、すなわち、後者において成形の際溶融樹脂が筒体２内より外部の合成樹脂部４ｂを構成するべく高出力（通常射出成形時の溶融合成樹脂圧力は250～600㎏／㎠である）に通孔６を通して外部に流出してくる際にその圧力により通孔６の縁部１１を立ち上げるものである。第１０図、第１１図、第１２図は縁部１１が立ち上がるべく構成されている通孔６の他実施例を示すものであるが、切り込み部１２が筒体２の軸方向に長くなるのは筒体２の強度を低下させるので好ましくない。第１２図に示す通孔６は樹脂注入の際に開口する。なお、上述のように縁部１１の立ち上げ形状は成形の際に形成するが、通孔６を打ち抜いて設ける際に同時に設けておいてもよい。

上記した実施例においては、機能軸体１を動力伝達用軸体としたもので、上記実施例の他機能部材Ａ３と機能部材Ｂ５とを適宜ギヤやプーリーやローラーやカム等にすればよい。この他に考えられる実施形態としては、冷暖房機能の横断流ファンや麺類の押切り製造機の軸体があげられる。

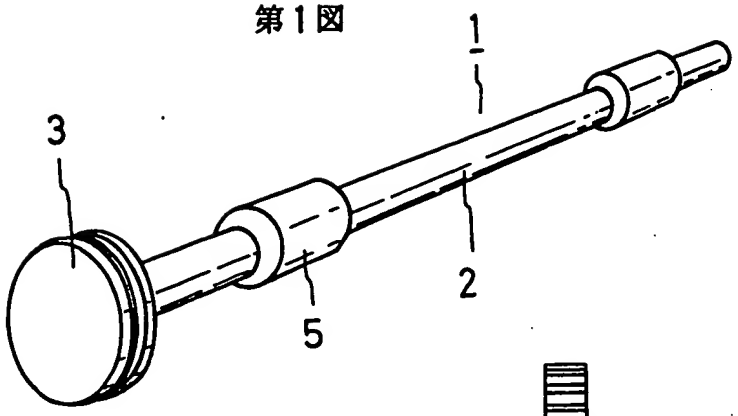
この発明は上述のように構成されている機能軸体であり、製造容易に得られ、しかも筒体が骨組みとなるべく用いられるので、歪んだりする心配がなく回転の際に振れが起らないものである。また、機能部材Ｂは筒体の内部の合成樹脂部と連続するので強固に設けられており、さらに、この機能部材Ｂと別個に設けられる機能部材Ａも有するので、種々多彩な機能を発揮できるものである。

図面の簡単な説明

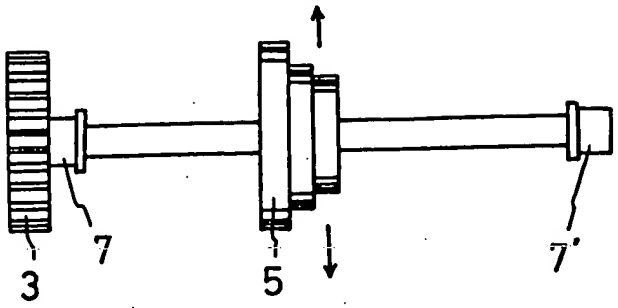
第１図はこの発明の実施例斜視図、第２図は同縦断面図、第３図はこの発明の製造状態説明省略側面図、第４図は他実施例側面図、第５図、第６図は機能部材Ａの取付け実施例斜視図、第７図は筒体の通孔付近の他実施例縦断面図、第８図は第２図に示すものの通孔を示す平面図、第９図は第７図に示すものの通孔を示す平面図、第１０図、第１１図、第１２図は通孔の他実施例平面図である。

１……機能軸体、２……筒体、３……機能部材Ａ、４……合成樹脂部、５……機能部材Ｂ、６……通孔。

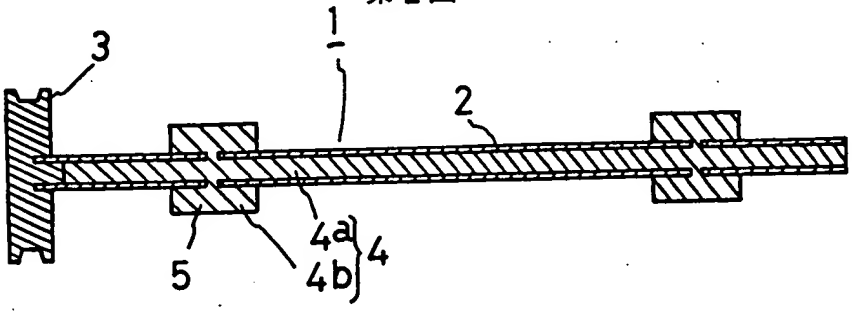
第1図



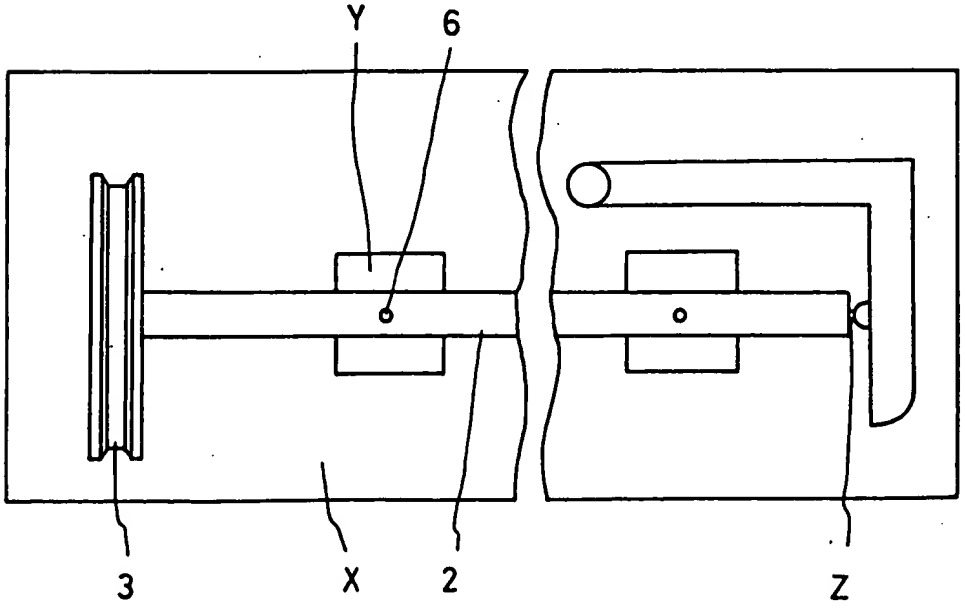
第4図



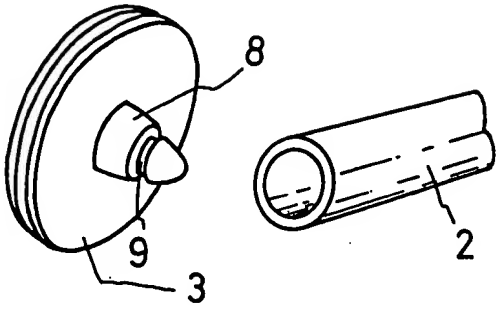
第2図



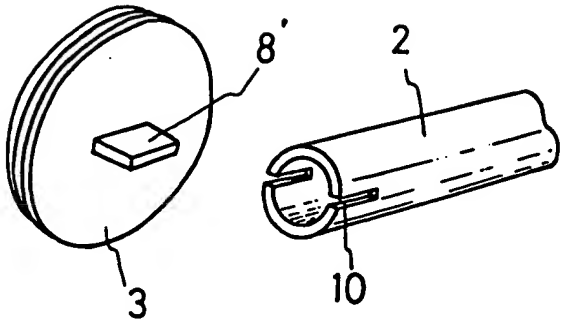
第3図



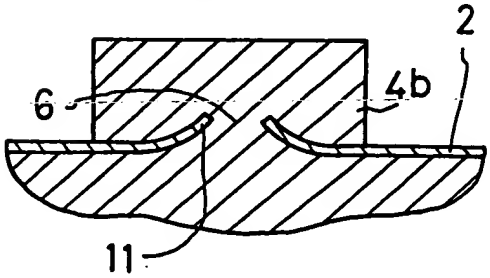
第5図



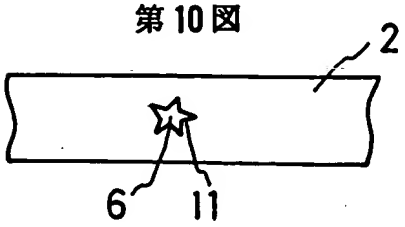
第6図



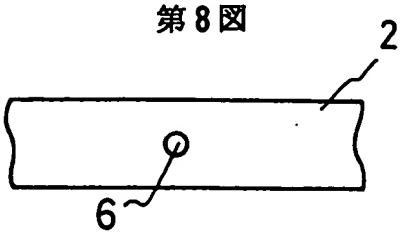
第7図



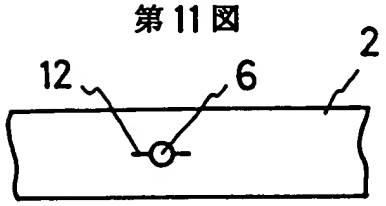
第10図



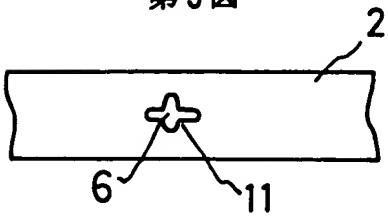
第8図



第11図



第9図



第12図